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The surface-active spider fauna of arid bushland in Kora Reserve, Kenya*

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Summary

The community of spiders captured in pitfall traps in three biotopes in arid bushland in Kora National Reserve, Kenya is described. Although collected during a long drought, the fauna was rich with a total of 68 species trapped in less than three weeks. Among 20 families represented Salticidae, Zodariidae and Gnaphosidae dominated in terms of species numbers. Relative abundance of species trapped showed an extremely skewed distribution with only 4 represented by more than 25 individuals and 29 (43%) represented by one individual. The results are discussed in relation to comparable data from other ecological zones of Africa.

Introduction

Information on the ecology and faunistics of spider communities in Africa is sparse. Previous studies include those on the humid savanna of Lamto, Ivory Coast (Blandin, 1971, 1972; Blandin & Célérier, 1981), on semi-deciduous fallow bush at Ibadan, Nigeria (Russell-Smith & Perfect, in prep.), on Miombo woodland in Zaire (Malaisse & Benoit, 1979) and on Mopane woodland and floodplain grassland in Botswana (Russell-Smith, 1981). These studies have provided valuable information on faunistics and seasonal activity of spiders in different ecological zones in spite of differences in methodologies and taxonomic problems. However, the sites studied cover a limited range of rainfall, from about 500 mm per annum in Botswana to about 1300 mm in Ivory Coast. There are no available data on spider communities of either very arid or very humid zones.

As part of a general study of the flora and fauna of the recently established Kora National Reserve, Kenya (Coe, 1984) two of the authors (N.M.C. & J.M.R.) carried out pitfall trapping in an area of the Reserve adjacent to the Tana river. Despite the extremely brief trapping period which was undertaken during a long drought the spider fauna was found to be very diverse. The lack of information on spiders in this type of habitat and the intrinsic interest of such arid ecosystems justify a short note on the findings.

Study area and Methods

The study area will be described in another paper (Collins *et al.*, in prep.) and only salient features are included here. Kora Reserve lies on the south bank of the middle reaches of the river Tana (0°00′ & 0°30′S, 38°25′ & 39°00′E). Altitudes in the reserve vary between 250 and 500 m. Mean annual rainfall for the area is approximately 250 mm but is distributed erratically both between seasons and years. At Garissa, to the east of the reserve, mean annual rainfall is 312 mm but the probability of receiving more than 50 mm is only 50% for the two wettest months, November and December. At the time of sampling no rainfall had been reported in Kora for the past 18 months.

Trapping was carried out near the edge of the Tana river close to the Kora project base camp (Map Ref. DK 581948). Three distinct, but adjacent, biotopes were sampled; a sandy beach adjacent to the river (30m wide), a zone dominated by *Salvadora persica* L. located on a river terrace (20 m wide), and finally *Acacia/Commiphora* bushland. In the *Salvadora* biotope the only other common woody species were *Acacia elatior* Brenan, *Lawsonia inermis* L. and palms, *Hyphaene ventricosa*. The *Acacia/Commiphora* bushland was dominated by *Acacia tortilis* Forsk (Hayne) and *Commiphora africana* (sensu lato) but had a diverse shrub layer which included *Acacia seyal* Del., 4 species of *Commiphora*, 2 species of *Lannea* and *Sterculea stenocarpa* H. Winkler. The bushland had an open canopy 3 m high with emergents attaining 5 m. At the time of sampling a field layer was virtually absent due to the extremely dry conditions.

Initially 63 pitfall traps were placed at random in each of the three biotopes with at least 2 m spacing between traps. The traps were operated for 4 days except for those on the beach where the last day's results were lost due to flooding. A second series of traps was spaced at 2 m intervals along a 200 m transect running at right angles to the river and crossing all 3 biotopes; 20 traps were placed in the beach, 20 in the *Salvadora* zone and 58 in the *Acacia/Commiphora* zone. The traps were operated over an eight-day period at the beginning of August.

Each trap consisted of two plastic coffee cups, 7.6 cm in diameter and 8.2 cm deep, placed inside one another and buried to the lip in the ground. The inner cup could be removed from the outer one for emptying without undue disturbance to the surroundings. The traps were half filled with water with a few drops of odourless detergent added and were emptied daily. The catch was retained on a fine mesh sieve before transferring to 70% ethanol for subsequent sorting and identification.

Results

During the 12-day trapping period a total of 68 spider taxa were obtained. Among these only 7 were trapped on the river beach, 37 were trapped in the *Salvadora* zone (17 confined to this biotope) and 45 were trapped in the *Acacia/Commiphora* bushland (25 confined to this biotope). On the basis of the numbers of traps operated in each biotope the beach zone was poorer in species (10% of the total) and the *Salvadora* zone considerably richer in species (54% of the total) than would have been expected, while the *Acacia/Commiphora* biotope had close to the proportion expected. The *Acacia/Commiphora* biotope had the highest proportion of species confined to it (37%) and the beach zone the lowest (6%). Thus although the *Salvadora* zone had an unexpectedly high proportion of species in relation to the number of traps it also had the highest degree of overlapping species with the other two zones.

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The family composition of the fauna as a whole (i.e. from both series of traps) is shown in Table 1. In terms of species numbers the Salticidae were most abundant (19.1%) followed by the Zodariidae (14.7%) and Gnaphosidae (13.2%). Other families represented by 4 or more species included Thomisidae, Lycosidae and Oonopidae. Among the 24 families present 14 were represented by only a single species. Only 28 of the 68 taxa were identifiable at present to generic level — a reflection both of the high proportion of immature specimens in the sample and the poor state of taxonomy of African spiders. Both Gnaphosidae and Zodariidae included a large number of currently unidentifiable species.

The relative abundance of species in the traps showed an extremely skewed distribution. Only 4 species were represented by more than 25 individuals. These included an unidentified zodariid (383 specimens), *Diores triarmatus* (Lessert) (172), a salticid belonging to the genus *Stenaelurillus* (244) and a lycosid, *Arctosa* sp. (113). The first three of these species were trapped in both the *Salvadora* and the *Acacia/Commiphora* biotopes. Adults of the *Arctosa* sp. (a genus characteristic of wet habitats in Africa) were confined to the *Salvadora* biotope but immatures were also taken on the river beach. 29 of the species trapped (43%) were represented by single individuals alone, the majority taken in the *Acacia/Commiphora* biotope. This makes it difficult to assess the degree of differentiation of the spider faunas of the *Salvadora* and *Acacia/Commiphora* biotopes.

Discussion

Family composition of the fauna

The most striking feature of the family composition of this sample (Table 1) is the abundance of species of the family Zodariidae, which accounted for just under 15% of all species trapped. They also accounted for a significant proportion of all individuals trapped. In no other African habitat studied to date are zodariids so important in either numbers of species or of individuals. It is tempting to speculate that this is associated with the abundance of ants in very arid habitats, since at least some zodariids are known to be specialist predators of ants. However, the feeding habits of African representatives of the family have not been studied and no firm conclusions can be drawn on this matter. The other two families which were well represented at Kora, Gnaphosidae (13.2%) and Salticidae (19.1%), have been found to be well represented in all African habitats studied (Table 2).

Thomisidae were also well represented in the Kora sample although many of the species may have been only casual visitors to the ground from the field and shrub layers (see Blandin, 1972). Lycosidae were rather poorly represented but are probably more abundant during wet periods. Several families were present in the Kora sample that have not been previously taken in systematic sampling in other ecological zones. They include Loxoscelidae, Urocteidae, Oecobiidae and Cithaeronidae. The latter is a very poorly known group, perhaps related to the Gnaphosidae, currently being studied by N. I. Platnick. All of these groups are known to be well adapted to arid conditions although oecobiids also occur in more humid areas.

The large number of families (24) and of species (68) trapped in a collection period of less than 3 weeks is doubtless partially a reflection of the number of traps used. Nevertheless, the figures were certainly surprising in the light both of the low and erratic rainfall at Kora and of the long drought that prevailed at the time of sampling.

Comparison of species numbers with those from other African habitats

Comparisons between African habitats are

Family	No. of species	%	Family	No. of species	%
Barychelidae ?	2	2.9	Lycosidae	4	5.9
Scytodidae	2	2.9	Gnaphosidae	9	13.2
Oonopidae	4	5.9	Cithaeronidae	1	1.5
Loxoscelidae	1	1.5	Clubionidae	1	1.5
Zodariidae	10	14.7	Ctenidae	2	2.9
Palpimanidae	1	1.5	Heteropodidae	1	1.5
Ochyroceratidae	1	1.5	Selenopidae ?	1	1.5
Urocteidae	1	1.5	Thomisidae	6	8.8
Theridiidae	1	1.5	Salticidae	13	19.1
Theridiosomatidae ?	1	1.5	Filistatidae	1	1.5
Oxyopidae	2	2.9	Dictynidae	1	1.5
Pisauridae	1	1.5	Oecobiidae	1	1.5

Total species 68 Total families 24

Table 1: Family composition of spiders from pitfall traps, Kora National Reserve, Kenya with percentages of total.

complicated by differences in sampling techniques and intensities and, in the case of the Kora study, the very short sampling period. However, for studies where pitfall traps have been used, comparisons can be made on the basis of equivalent trapping effort (i.e. numbers of species taken per trap-day). In Table 2 we compare numbers of species trapped in approximately equivalent dry-season periods in three different ecological zones in Africa. For this purpose we have used only the results from the preliminary series of pitfall traps at Kora in order to give a trapping effort close to those for the other habitats. Addition of the species from the transect series of traps considerably alters the proportions of species in different families but since it would be based on a very much higher trapping effort (1453 trap-days) these have been ignored. The figures in Table 2 are for 693 trap-days at Kora, 610 trap-days in Mopane woodland and floodplain grassland in Botswana (Russell-Smith, 1981) and 555 trap-days in semi-deciduous bush in Nigeria (Russell-Smith & Perfect, in prep.). Some clear differences in the composition of the fauna of these habitats can be seen. In the Kora sample the three most diverse families were Salticidae, Zodariidae and Thomisidae. In the two semi-arid habitats in Botswana Salticidae were also among the three most diverse families but Gnaphosidae represented the single most diverse family in both habitats. It might be noted that the very high proportion of gnaphosids from the two Botswana sites (Table 2, cols. 2 & 3) may reflect zoogeographical factors other than habitat preference since there is some evidence that southern Africa represents a centre of diversity for this family. Lycosidae were important in the semi-arid grassland but not the woodland and the reverse applied to the Oonopidae. In the semi-deciduous fallow bush in Nigeria Oonopidae was the most diverse family followed by the Gnaphosidae and Salticidae. The largest number of families was trapped at Kora and the lowest in the two semi-arid habitats in Botswana. It should be noted that in this analysis the figures for the three biotopes at Kora have been summed. If these were treated as completely separate habitats then only 33 species would have been taken in the *Acacia/Commiphora* biotope and 26 in the *Salvadora* biotope; figures lower than those for the two semi-arid habitats in Botswana.

Although such comparisons should be treated with some caution, both because the trapping effort in the different studies was not exactly equivalent and

	Kora, 3 biotopes		**Botswana**		**Botswana**		**Nigeria**	
Habitat	**(Trap Series I)**		**Floodplain grass**		**Mopane woodland**		**Fallow bushland**	
Annual rainfall	**250 mm**		**525 mm**		**525 mm**		**1250 mm**	
	Nos.	**%**	**Nos.**	**%**	**Nos.**	**%**	**Nos.**	**%**
Family								
Dipluridae	0	—	0	—	0	—	1	1.9
Barychelidae ?	1	2.1	0	—	0	—	0	—
Ctenizidae	0	—	1	2.4	1	3.3	0	—
Scytodidae	1	2.1	1	2.4	1	3.3	0	—
Oonopidae	4	8.5	2	4.9	3	10.0	11	20.7
Loxoscelidae	1	2.1	0	—	0	—	0	—
Zodariidae	6	12.8	0	—	1	3.3	2	3.8
Palpimanidae	1	2.1	0	—	0	—	1	1.9
Leptonetidae	0	—	0	—	0	—	1	1.9
Ochyroceratidae	1	2.1	0	—	0	—	2	3.8
Urocteidae	0	—	0	—	0	—	0	—
Theridiidae	0	—	0	—	0	—	2	3.8
Linyphiidae	0	—	1	2.4	0	—	3	5.7
Araneidae	0	—	1	2.4	0	—	5	9.4
Theridiosomatidae ?	1	2.1	0	—	0	—	0	—
Agelenidae	0	—	0	—	1	3.3	0	—
Oxyopidae	1	2.1	2	4.9	1	3.3	1	1.9
Pisauridae	1	2.1	0	—	0	—	1	1.9
Lycosidae	4	8.5	6	14.6	1	3.3	2	3.8
Gnaphosidae	4	8.5	14	34.1	13	43.3	9	17.0
Cithaeronidae	1	2.1	0	—	0	—	0	—
Clubionidae	0	—	1	2.4	1	3.3	4	7.5
Ctenidae	2	4.3	0	—	0	—	0	—
Heteropodidae	1	2.1	0	—	0	—	0	—
Selenopidae ?	1	2.1	0	—	0	—	0	—
Thomisidae	6	12.8	2	4.9	1	3.3	2	3.8
Salticidae	8	17.0	10	24.4	6	20.0	6	11.3
Filistatidae	1	2.1	0	—	0	—	0	—
Dictynidae	0	—	0	—	0	—	0	—
Oecobiidae	1	2.1	0	—	0	—	0	—
Total Species	47		41		30		53	
Total Families	20		11		11		16	

Table 2: A comparison of numbers of species and proportions of different spider families trapped in the dry season in four different African habitats. For sources of data and method of calculating numbers of species see text.

because of the different trapping efficiencies of pitfalls in different habitat types, the figures in Table 2 do not suggest that, in the dry season at least, the Kora site was significantly poorer in species than more humid areas of Africa. Whether this would be true if sampling had been continued throughout the year is impossible to say and underlines the need for further studies in arid habitats in Africa.

Zonation of the fauna

There is little doubt that the river beach, with its impoverished fauna, represents a distinct, and possibly marginal, habitat for spiders. Frequent flooding due to release of water from upstream dams would render it particularly insecure for most species. How one regards the distinction between the faunas of the *Salvadora* and *Acacia/Commiphora* biotopes depends on the method of analysing the data. If all species are assigned equal weight (regardless of numbers) then the two biotopes can be considered reasonably distinct, with only 30% of the species from both biotopes shared between them. However, all the abundant species trapped were found to occur in both the biotopes and the apparent differences between them may have been an artefact of the relatively short trapping period. Had more species been taken in reasonable numbers the similarity between the two biotopes might have appeared greater.

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